Testimony of
Dr. George Strawn
Division Director
Advanced Networking Infrastructure and Research
National Science Foundation

Before the Subcommittee on Telecommunications,
Trade and Consumer Protections
House Commerce Committee
On Internet Domain Name System
June 10, 1998

Mr. Chairman, members of the subcommittee, thank you for allowing me the opportunity to give a brief presentation on the Internet domain name system, how it began, why it was created and how it operates. I am Dr. George Strawn, Division Director for Advanced Networking Infrastructure and Research in the Directorate for Computer and Information Science and Engineering of the National Science Foundation.

Federal government support of fundamental research and development has been critical to the growth of the Internet and information technology in the United States. The Internet has its roots in the pioneering work supported by the federal government over several decades: from research first supported by the Department of Defense in the mid 1960's, to the sponsorship of the NSFNET by the National Science Foundation in the mid-1980's, to today's robust global activity on the World Wide Web.

According to the Computing Research Association, the United States now holds a commanding lead in Internet technology and that lead is "the result of an extraordinary 50-year partnership among government, industry and academia". That partnership was integral to the creation of the Internet and will be integral to the creation of the next generation of computer-communication technologies.

NSF has supported some of the most successful and innovative computer-communications concepts and technologies at their earliest, most experimental stages.

Significant NSF-supported breakthroughs include:

- **Creation of the popular MOSAIC web browser software** – This development spawned industry leader Netscape Communications and eventually led to the blossoming of a multi-billion dollar industry.

- **Network video-conferencing software** – CUSeeMe Software developed through NSF support was one of the first software programs for low-cost video conferencing. It is the precursor of most Internet video conferencing software commercially available today. CUSeeMe is now available free on the Internet and is widely used in many elementary and secondary schools.

- **CAVE 3-D Virtual Reality –** This 3-D environment gives scientists and engineers a powerful tool to visualize their data. A researcher can walk through the enzyme she is studying or fly through a developing galaxy as seen, for example, in the new IMAX film "Cosmic Voyage".

This support has led to significant accomplishments and breakthroughs that have not only pushed the frontiers of science and engineering forward, but have created real economic and societal benefits for the Nation and the American people. At NSF we are proud of our record of accomplishment in computer networking and communications. We hope to build on this record in the future.

NSF Support of the Internet

To understand the complex issue of Internet Domain Name registration more fully, I want to first discuss briefly NSF's role in fostering the growth of the Internet. The domain name issue has roots in the early development of the Internet and the present system of domain name registration stems from decisions made when the Internet was conceived and used as a tool dedicated primarily for research and education.

The Internet began with the creation of a system for communication among networks designed and used by small groups of government and academic researchers. The earliest group was engaged in military research that received principal support from the Department of Defense in the 1960's and 70's. Scientists and engineers at U.S. universities working on basic research funded primarily by the National Science Foundation soon began to join the network. In the mid-1980's, NSF began supporting national supercomputing centers in order to enable U.S. scientists, engineers and their students greater access to state-of-the-art, high performance computing.

Creation of these national supercomputer centers by NSF was critical to the development of the Internet. To further enhance U.S. scientists' access to these centers, NSF established the NSFNET national backbone network that connected the NSF supercomputing centers to U.S. universities.   NSF also promoted the creation of regional networks to connect colleges and universities to the NSFNET. When the NSF-supported regional networks sought additional members from the private sector, one of the great technology transfer successes of all time was set in motion.

I cannot overstate the enormous differences in the computing and communications environment just a few short years ago when compared with today.   A good example is the vast increases in computing power that have occurred during this time. Today a Nintendo game machine contains roughly the same amount of computing power as the most powerful supercomputers in the world in only a few years ago.

The Domain Name System – A Brief Overview

The Internet is now a mainstream communications medium. You cannot watch T.V., listen to radio or glance at a billboard without seeing an Internet domain name. Domain names are the .gov's, .edu's and especially the .com's, where individuals, governments, schools and corporations maintain a presence on the World Wide Web.

A key strength of the Administration's White Paper is that it is comprehensive in scope, creating a new not-for-profit entity formed by the private sector that will address all of the elements of the Domain Name System.   This is because the domain name system is actually comprised of several elements that work together, including:

- Internet Protocol Numbers and their assignment;
- The Root Server System – a set of file servers that together contain authoritative databases listing all top level domains; and
- The system of registering names for Internet users – the familiar .com, .edu domain names and others.

Like the phone in your home or office, each of the millions of individual computers connected to the Internet has one or more unique 12 digit numeric "addresses" to permit other connected computers to send communications to it.   Thus every computer connected to the Internet has a numeric address, called an IP number.[1]

The domain name system was an attempt to make these numeric addresses unnecessary to remember. Initially when there were only a few hundred computers connected to the network, users informally assigned names to their computers and these names were tracked and associated with their corresponding numbers in a file maintained centrally but available to all sites. The current domain name system came into being in 1987, when the Department of Defense was still the principal supporter of what was then a mostly U.S. domestic system of the interconnected

---

[1] This addressing system was established in the mid-1980's by an informal standard-setting group. Initially, as an administrative outgrowth of the ARPANET experiment, these numeric addresses were maintained and assigned to insure uniqueness by the Internet Assigned Numbers Authority (IANA).

networks forming the Internet.

The Internet at this point had grown to about 2,000 active computers and a decision was made to implement a formalized hierarchy of alphabetic names and a regular, scalable system for their distribution. Most of the connected sites could be easily identified by their institutional name and a three letter descriptive abbreviation known as top level domains or TLDs:

- .INT for international treaty organizations:
- .MIL and .GOV for military and civilian federal agencies;
- .EDU for colleges and universities;
- .ORG for non-profit entities;
- .NET for network service providers; and
- .COM for commercial entities.

The three-letter Top Level Domains were intended to describe the type of organization that was registering. As the system expanded to other countries, two-letter country codes such as .UK for the United Kingdom, .FR for France, or .CA for Canada were added, among many others.

History of Domain Name Registration

In the mid-1980s, most new registrants on the "research internet" were research and educational institutions – primarily in the .edu TLD – which were likely to be supported by NSF and other civilian research agencies, rather than military sites and defense contractors. Consequently, DOD sought to reduce its involvement and funding.[2]

When DoD determined that it was no longer appropriate for them to support non-military registration that was unrelated to the defense effort, a group of the federal agencies involved in using or supporting the Internet[3] asked NSF to assume responsibility for supporting registration services for the non-military portion of the Internet.

In April 1993, in order to serve an expanding base of research and education users, NSF, after an open, competitive process, entered into a 5-year cooperative agreement with Network Solutions, Inc.. Our objective was to provide support for Internet registration services for the non-military part of the Internet, which was then primarily composed of research and education institutions.

---

[2] Prior to 1993, registration of first-and second-level domain names was performed by the Defense Information Systems Agency Network Information Center (the DISA NIC), a contractor-operated facility.

[3] The Federal Networking Council (FNC)

When the Internet was a U.S. government-supported research project, the original authority overseeing the registration of Internet addresses rested on the consent of the governed. Today, the vast majority of domain name registrants are commercial interests whose activities now go well beyond the research and education community that NSF is chartered to serve. Now that the Internet is a global industry, the "Internet Community" is struggling to find an appropriate structure commensurate with the demands and novel issues of this burgeoning enterprise.

This rapid growth and transfer to the private sector of the Internet is a success story of which the Congress and the Executive Branch should be proud. In 1980, scientists and engineers had only limited access to the highest levels of computational power. Today, they employ desktop systems with power comparable to the supercomputers of the late 1980's and now, linking these workstations through the Internet, these same scientists and engineers also have access to a collection of supercomputing facilities with capabilities they could only dream about a decade ago. Over this same period, the number of host computers on what is now the Internet has leapt from about 200 to over 10 million in 1996 -- a 50,000 fold increase.

The Future of Domain Name Registration: Promoting Private Sector Solutions

NSF has been slowly withdrawing our support of technologies and concepts related to the commercialized Internet. This shift includes our decommissioning of the original NSFNET backbone in 1995 and our recent determination that further support of Internet domain name registration should be transferred to the private sector.

The reason for this transition is obvious. It is clear that the Internet is now the domain of the venture capitalist, not the adventurous academic. Internet companies that did not exist five years ago are now giants in a billion-dollar industry and are front page news. The Internet has become a global communications infrastructure, it is no longer a medium that primarily supports the conduct of Federally-supported research within the science and engineering research and education community -- the original reason for NSF involvement.

NSF believes its strength and expertise lies in the support of merit-based, cutting-edge research and education in such areas as the Next Generation Internet Initiative.   Through these new initiatives, the Foundation hopes to take computing, information and networking to a new level of technological, economic, educational, and societal impact, continuing to enhance Internet capabilities for research and education and subsequently for many other societal purposes. NSF will continue to invest in research and education efforts to change how we learn and create, how we work and how we live.

While NSF has determined that our role in domain name registration should be concluded, we also recognize our special relationship with the Internet.   That is why we support the principles for management of the Domain Name System that are expressed in the just-issued White Paper. We will do so by pursuing the following objectives:

> Ensuring Stability – While we will no longer provide support for what is now a private sector enterprise, we will promote actions that will ensure stability of the system – a system that works;

> Promoting Self-Support – NSF will pursue policies that will spur private sector solutions to Internet registration. It is our belief that this transition should occur as soon as is practicable.

As I mentioned earlier in my testimony, we are proud at NSF of our record of accomplishment in fostering the growth of the Internet and we hope to build on this record in the future. This means that NSF will turn to supporting even more innovative communications and computing projects, while the private sector should be allowed to take the lead in solving the "growing pain" problems associated with the Internet. That is why NSF is working with the Department of Commerce and the other relevant agencies to ensure a smooth transition to a regime where the Internet can continue to flourish as a stable global communications network of the 21st Century, free of overly intrusive federal regulation or oversight.

Thank you.